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country, which is herewith submitted as part of its report to be printed in the Proceedings of the Society.

The Committee submits the following resolutions, which it desires shall be passed by the Society.

Resolved, That the sum of two hundred and fifty-five dollars be appropriated out of the income of the Michaux fund towards the expenses of the Thirteenth Course of the "Michaux Forestry Lectures," by Dr. J. T. Rothrock.

Resolved, That the paper of Prof. Heilprin, entitled "Observations on the Flora of Yucatan," as well as the paper presented by Dr. Rothrock entitled "Some Observations on the Bahamas and Jamaica," in the nature of report to the Michaux Committee of his visit to these Islands in 1891, be printed in full in the Proceedings of the Society as part of the report of the Michaux Committee.

By order of the Board,

J. SERGEANT PRICE, *Secretary*.

The resolutions, as reported, were adopted by the Society.

Observations on the Flora of Northern Yucatan.

By Prof. Angelo Heilprin.

It is not a little singular that while the Mexican region as a whole has from the beginning of the century to the present day attracted the attention of botanists of all nations, and contributed more largely to the initial understanding of geographical botany than perhaps any other region of the globe, the Province or State of Yucatan should not have drawn to it a single botanist of note. Indeed, it is only in the last few years that any systematic effort has been made towards the determination of its flora, even the relationship of which has not yet been precisely ascertained. Grisebach, in his *Vegetation der Erde* (1884, Vol. ii, p. 301), dismisses the region with the bare statement that unfavorable climatic and physical conditions prevent luxuriance of vegetable development, and Hemsley, in his report upon the botany of Mexico and Central America, prepared for Godman and Salvin's *Biologia Centrali-Americana* (*Botany*, iv, p. 151, 1888), merely asserts our ignorance in the following words: "Before concluding this part, we may add that little is known of the details of the botany of Yucatan, except that it is very poor and scanty, and largely composed of plants that still bear long droughts without injury. The poverty of the flora is ascribed to the fact that the copious rains rapidly filter away through the porous limestone substratum." Drude, in his *Handbuch der Pflanzengeographie* (1890), ignores the region entirely. In view of this very limited knowledge of the flora of a country so interesting

as is Yucatan, I venture to submit a few general observations which were hastily picked up during a field reconnaissance made in the early part of 1890 (late February and March), principally in the interests of geological and zoölogical research. The collection of plants, which serves as a basis for some of the determinations referred to in this paper, was made by Mr. Witmer Stone, one of my associates in exploration, to whom I am indebted for notes and remarks on distribution, etc. I desire in this place also to acknowledge my indebtedness for various favors to D. Emilio MacKinney, of Merida, Yucatan; the author of the now progressing *Nuevo Judío*,* who has kindly assisted me in the determination of species not in flower, and of which specimens could not readily be obtained for our collections, and also furnished the local or Maya names.

Perhaps the traveler's first surprise on landing in Yucatan is that his eyes do not immediately fall upon a line of lofty primeval forest; secondly, he may be distressed by the utter barrenness which at times distinguishes much of the region that is covered by the bush or "jungle." This is the condition throughout much of the dry season when the trees and bushes, instead of being buried in dense and brilliant verdure, are as bare as though they had just passed through the tail end of one of our northern winters. The more striking does this condition appear when it is recollected that the region under consideration is well within the tropics, but little elevated above the level of the sea, and seemingly well fitted for the development of a rich and luxuriant flora. In the region first visited by us—the flat limestone tract included between the seaboard and the capital city—the vegetation is monotonous to a high degree. There is little of that variety of form which we are accustomed to associate with the vegetation of the south—little or nothing of the life which astonishes by its exuberance. By far the greater number of the arboreal elements of the scrub—for it is more nearly scrub than either jungle or forest—belong to the group of the Leguminosæ, among which the *yaxhabin*† (a species of Cassia) and the dog-acacia or *subinché* (*Acacia cornigera*), with their abatis of thorns, stand out as prominent members. Beyond the presence here and there of one or more species of cactus (*Cereus Peruvianus*, *C. flagelliformis*, *Cactus opuntia*) and the vision of distant cocoa-palms and oranges, there is little to remind the stranger from the north that he is not traveling in his own country. There are no large foresters swinging garlands of evergreens to the breeze, no canopy of flowers to waft perfume to the air. All about are tree-like bushes, fifteen to twenty-five feet in height, thin and so spare in their foliage as to permit of but indifferent shade, and most of them stocked with a wonderful armor of hooks and thorns. There are few flowers on the interground, and what appear on the branches above are almost wholly of a yellow color—the flowers of the Cassia and of the numer-

* *El Nuevo Judío*: *Apuntes que servirán para la formación de La Flora Yucateca*. Merida, 1889.

† Pronounced with the German pronunciation of the vowels, *yashabin*. The x which appears in many of the Maya or Yucatecan words, as in Uxmal, has the sound of sh.

ous associated Acacias. These may be taken to represent the white blossoms of our cherry and dogwood. Here and there the eye catches a glimpse of a solitary screw-pine, the *gipil** of the Mayas (*Pandanus candelabrum*), a plant which seems to have pretty firmly engrafted itself upon the Yucatan flora.

Withal that is lacking to indicate a tropical flora there is equally little that is really distinctive of the northern woods; there are no oaks, maples, beeches, poplars, junipers, cedars or pines. Excepting the Acacias we failed to detect a single genus of northern forest trees.† Yet the total impression produced by the vegetation was one immediately suggestive of the north, and not of a flora intermediate in character between that of the north and that of the south. The largely denuded condition of the trees undoubtedly conduced towards this impression.

This is the picture of the limestone flats between Progreso and Merida, and of much of the region lying to the east, south and west of the capital city; it is the picture as we found it in the dry season, in the month of March, before nature had yet begun to respond to those refreshing influences which are the offering of the rainy season.‡ It was the tropical winter. But even at this season of the year there were pieces of landscape that were fragrant in their verdure. Wherever the hand of man had transformed the native scrub into the fertile, but ever dreary and monotonous, hennequen country, with its countless aloes (*Agave rigida?* var. *A. Sisalana*) planted in avenues of geometrical precision, the eye is sure to rest upon a number of scattered garden spots. They are the groves of the haciendas, and it is difficult to conceive of anything more brilliant or refreshing than these oases in what might be termed a fertile desert. The dense masses of foliage of the orange, *ramon* (*Brossimum alicastrum*), and one or more species of *Ficus* (*F. longifolia*), with their deepest tints of green, and the overarching plumes of the cocoanut, offer a sharp contrast to the bleak expanse of hennequen, and a picture of loveliness not soon to be forgotten.

Along the roadways and in the gardens of Merida numerous examples of the true arboreal vegetation of the tropics are to be met with. Conspicuous among these are the silk-cotton tree (*Bombax ceiba*) and the *bonete* or *kumché* (*Jacaratia Mexicana*), both of which assume the stately proportions of forest trees. At the time of our visit they were already in full fruit, although they as yet showed scarcely a vestige of leaf. This peculiarity, so novel to the stranger, was also true of most of the larger trees, such as the sapote (*Sapota achras*), pochote (*Eriodendron anfractuosum*), the so-called native cedar or cedro (*Cedrela odorata*), etc. The

*The Maya O, or reversed C, is pronounced as a short lingual tz.

†So many of the bushes and trees being destitute of leaf, and therefore largely unrecognizable, it is possible that more of the temperate forms are actually represented than appeared to us to be the case.

‡Returning to Progreso in the early part of June, I found that the vegetation, although considerably advanced, was still backward as compared with that of the eastern lowland plains of major Mexico, and in every way much less luxuriant.

plum or siruela (*Spondias*) was also bearing heavily, but it still bore traces of flowering. One of the most ornamental trees of the roadside is the "southern pine" or *Casuarina*, which also thrives extensively in the open and windy sand spots of Progreso.

The tree which at the time of our visit gave the tone of luxuriance to the vegetation was the ramon (*Brossimum alicastrum*), the dense masses of whose foliage are a refreshing object in the street scenery of almost every town in northern Yucatan. It is extensively cultivated for horse and mule fodder, and thus frequently appears for cause stripped of its leaves for a height of thirty to forty feet. It then shows to advantage the brilliant contrast between its pale gray, almost white, trunk and the dark green of its crown. Plants with showy flowers were not numerous, and the flowers where occurring were not specially remarkable either for beauty or for fragrance. There were, however, one or two notable exceptions, which went far to redeem the reputation of the tropics. One of these was the tree known in the Maya language as *xkuiché*, which comprises the two species familiar to botanists as *Pachira alba* and *P. fastuosa*. Both forms were completely naked, except for the large tufts of red and white blossoms which were scattered over the branches. The tree is a favorite with the natives, and we met with it at numerous places along the open roadside; but its true home is the village garden. Scarcely less attractive in its display of flowers is the siricote (*Cordia Sebestana*), with its large and brilliant cups of scarlet, the abiding place of several species of humming-bird.

The picture of Merida and its surroundings, so far as the vegetation is concerned, is also the picture of much of the outlying region where settlements have effected a lodgment. The approach to every village is heralded by a growth of sabal or cocoanut, the former of which attains the dimensions approximately of the Florida palmetto, rising in graceful shafts sixty to eighty feet in height. Its most picturesque garb is seen when the tree is enclosed by the trunk and cable masses of the *copó* (*Ficus rubiginosa*), whose close embrace makes it appear as though the same trunk and roots were nourishing and supporting the lives of two very distinct organisms. The fig, of later growth, had wrapped its massive descending roots about the shaft of the palm, and in such a manner as to leave little or nothing of its fellow visible except the tufts of leaves. Manifestly the pseudo-parasite had started life from above, possibly from seeds deposited by a bird, gathering sustenance from the atmosphere and its contained impurities. I could find neither here nor in Mexico proper, where I subsequently had frequent opportunity of observing this growth, evidence of strangulation of the host. Inasmuch as the trunk of the palmetto does not materially increase in bulk after it first rises from the ground, I doubt much if this closing around causes any real injury to the plant attacked, contrary to the general belief of the natives. The finest specimens of the cocoa-palm were met with by us at a locality on the north coast known as the Serrito, a few miles to the east of the Puerto de Ojilam. The tree does not in this place grow to any great height, perhaps forty to fifty feet, but it appears

in full vigor, and many of the trees of the large grove, which is here bathed by the ocean breezes, were laden with fruits. Compared with the cocoa-palms which I subsequently met with in the Mexican region west and northwest of Vera Cruz, these appeared to be of a much more healthy type, and altogether their general aspect was much fresher. In the same region is also found the dwarf cocoanut (*Cocos coyol*).

In the mountain region forty to sixty miles south of Merida, or beyond Ticul, certain new elements are introduced into the vegetation, which impart to it a somewhat distinctive character; but, broadly speaking, the flora is still that of the northern limestone flats, with its acacias as the dominating feature. At several points on the northern flank of the Sierra, as between the hacienda of San Juan and Uxmal, and again between Ticul and the hacienda of Tabi, there are extensive growths of the red gum, the *chakah* of the Mayas (*Bursera gummifera*), the tree which yields much of the chewing gum of commerce. Like most of the larger for-esters it was destitute of leaves, and in its peculiarly dichotomizing branches and copper-colored trunk, it could not fail to attract the attention of the traveler. The tree grows to a height of some forty to sixty feet, and in such close association as to form woods of its own. I met with it in considerable abundance along the line connecting Vera Cruz and Jalapa, not far from the village of San Juan. Along the roadways and in the thinner jungle the lesser pineapple or piñuela (*Bromelia pinguin*) was very abundant, its long and rigid saw-like leaves, tipped with bright crimson, forming an effective foreground to the more delicate types of vegetation beyond. Especially beautiful is the effect produced by these plants at the approaches to the famous ruins of Uxmal; great tufted masses, five to seven feet in height, line the roadway on either side—a natural stockade alike impassable to man and beast.

Only along a comparatively short stretch of roadway between Izamal and Tunkas, on the Camino Real to Valladolid, did we meet with that phase of vegetable development which the mind popularly associates with a southern flora—a flora which is tropically luxuriant, and where luxuriance is dependent not upon the special growth of plants of a single order, but upon an assortment of largely heterogeneous elements. The beginnings of such a vegetation we found a few miles to the southeast of Siilpech. The limestone has here undergone deep decay, liberating a rich deposit of red earth, which has attracted a profuse and varied flora. The trees are very much larger than we had heretofore seen in the bush and some of them almost noble in their proportions. Manifestly they are the remains of a forest which was at one time far more majestic than it is to-day, and which dates its primal destruction probably to the period of the early colonization of the country by the Spaniards. The overarching boughs, decked with a profusion of dog-jessamine (*Tabernaemontana amygdalifolia*), orchids and air plants, especially the latter, help to form a dainty bit of road scenery which it would be difficult to match. Of the orchids, the *Cattleya* was especially abundant, forming by its large bunches great unsightly scars in the axils of the forest trees. We col-

lected also a number of *Oncidia*, etc. The epiphytes were mainly Tillandsias or Bromelias, which in places literally covered some of the large foresters, especially the *pich* (*Inga xilocarpa*). Among other components of the vegetation are the Spanish bayonet (*Yucca*) and Fourcroya, rising thirty to forty feet, and several species of cactus (*Cereus grandiflora*, *C. flagelliformis*, *Melocactus*). The first of these, the far-famed night-blooming Cereus, occurs in great sprawling masses, dependent from the lower branches of the bush. Here and there it is closely associated with the organ or giant cactus (*Cereus Peruviana*) and with other species to form dense and impenetrable thickets. Many of the plants were in flower at the time of our visit.

Three large cenotes, or, more properly, aguadas, those of Shkashek and Balantun, open up within a short distance of one another on this road, and their deep basins are largely encircled by a luxuriant growth of forest. Over the surface of two of these, great lily pads had encroached upon the water, recalling a picture from our own far north. In a second well a brake or cane, together with the *puh* (*Pandanus utilis*), had largely usurped the place of the lily. I observed here also a number of calabash bushes or trees (*Crescentia cujete*).

On the northern coast of the peninsula, adjoining the luxuriant *sapota*les of the Serrito, is a vast mangrove maze. Unlike the mangroves of the Southern United States, such as I had observed in profuse development on the western coast of Florida, or of Bermuda, the Yucatan mangrove is a noble forester, rising a hundred feet or more in height. The great air-shoots or roots descend from an elevation of fifty to seventy-five feet, and in their massiveness recall the giant cables of some of the *Ficaceæ*. In its general aspect the mangrove forest is most impressive—a wilderness of roots, stems and foliage, into which but little sunlight penetrates.

Attention has already been directed to the *scanty* character of the Yucatan sylvia; this is, indeed, the nature of the "jungle," which is referred to by nearly all travelers since the days of Stephens and which encompasses the sites of many of the larger ruins of the interior. The true forest jungle, such as is to be met with in the State of Tabasco or in the low Mexican region west of the Gulf, is wanting over the greater part of the extensive limestone plain of the north, nor does it show itself in the mountain tracts either. This condition has led botanists to assume that the northern half of the peninsula was climatically and physically unsuited to the development of the profuse and healthy vegetation which elsewhere distinguishes tropical Spanish America. Indeed, Grisebach goes so far as to assume that the deficiency of forms is mainly due to an absence of rainfall, which is, however, as well marked in Yucatan as it is in most non-mountainous tropical countries. The fallacy of this view has already been pointed out by Woeikof.* The scraps of luxuriant growth that appear here and there, taken in conjunction with the giant dimensions of some of the scattered foresters, seem to me to point rather to

* *Reise durch Yukatan und die südöstlichen Provinzen von Mexiko*, 1874. Petermann's *Mittheilungen*, 1879, p. 202.

favorable than to unfavorable conditions and to an explanation of the existing sparseness of the vegetation which has no connection with climatic or physical influences. I think it all but certain that an extensive forest at one time covered the land, and that successive devastations in one form or another have brought the surface to the condition in which we now find it. That the Spaniards here, as in Mexico proper, caused wanton destruction of the native forests is positive; but how often the destruction has been continued since the period of the conquest has not yet been determined.

The following brief notes on some of the plants observed by us may serve in a measure to elucidate the vegetation of northern Yucatan; most of the determinations have been made by Mr. MacKinney, who has also supplied the Maya names (the second name which occasionally appears in parentheses is the one in common use).

Cassia sp.? (*Yaxhabin*).—Tree, 15-20 feet, very abundant in the open scrub between the seaboard and Merida. Flowers bright yellow.

Acacia cornigera (*Subinché*).—Very abundant in the bush.

Acacia odoratissima? (*Baalché*).

Inga zilocarpa (*Pich*).—One of the largest of the roadside trees, 70-100 feet or more in height. This tree appears to be specially selected for decoration by the *Tillandsia*.

Bombax ceiba (*Yaxché*).—The silk-cotton tree is one of the giants of the Yucatan flora, of which it constitutes one of the distinctive features; 70-100 feet; very abundant. Specially noble examples of this tree, one of them measuring not less than eight feet in diameter, are found in the region about Ticul. Destitute of leaf at the time of our visit, but bearing an ample supply of pods.

Eriodendron anfractuosum (*Pochote*).—An abundant tree, mostly of smaller size than the *ceiba*; flowering.

Pachira alba, *Pachira fastuosa* (*Xcuyché*—*Amapola*).—Cultivated as ornamental trees; 15-25 feet; flowering, but devoid of leaves.

Brossimum alicastrum (*Ox*—*Ramon*).—Very abundant in all the village gardens; cultivated for fodder. Tree, 60-80 feet.

Ficus grandifolia (*Akúm*).—Large and abundant tree.

Ficus rubiginosa (*Copó*).—Very abundant as a pseudo-parasite on *Sabal*.

Ficus laurifolia—Shade tree in the park of Merida.

Jacaratia Mexicana (*Kumché*—*Bonete*).—Large and abundant tree—in fruit. The conspicuous triangular fruit is prepared in a variety of ways as an article of food.

Carica papaya (*Put*—*Papaya*).—The papaw; very abundant in gardens.

Bursera gummifera (*Chacah*).—Tree (destitute of leaf at the time of our visit) very abundant in the hill region south of Ticul; 50-60 feet.

Spondias lutea (*Abal*—*Xkinim-hobo*—*Siruela*).—One of the forms of Yucatan plum; extensively cultivated.

Spondias microcarpa (*Aac-abal*).

Spondias rubra (*Xkis-abal*).

Cordia Sebestana (*Kopté*—*Siricote*).—Abundant in gardens.

Cedrela odorata (Kulché).—Abundant in gardens in Merida and in nearly all villages.

Casuarina.—Abundant in gardens and in open places ; 30–60 feet.

Anona squamosa (Jalmui—Saramayo).—The custard apple.

Anona muricata (Guanávano).

Anona glabra (Op).

Sapote achras.—Much cultivated for its delicious fruit ; tree 50–80 feet.

Lucuma mamosa (Chacalhas).—The mamey.

Mamea Americana.—The San Domingo mamey ; extensively cultivated.

Persea gratissima (On—Aguacate).—Alligator-pear.

Plumeria alba (Nicté—Flor de Mayo).—Cultivated for its beautiful and highly aromatic flowers.

Tabernaemontana amygdalifolia (Uupek—Jazmin de perro).—Dog-jessamine. Very abundant along some of the roadways, as on the Camino Real between Izamal and Tekantó ; flowering.

Crescentia cujete (Luch—Jicara).—Calabash tree ; observed at the aguada of Shkashek.

Tecoma equinoctialis (Sac-ak—Bejuco de Chiquiuite).

Cucurbita pepo (Kúm—Calabassa).—Calabash.

Rhizophora mangle (Tupché).—Forming extensive forests on the north shore, east of the Puerto de Dilam.

Cereus Peruvianus (Nun—Organo).—The organ cactus, forming dense and almost impenetrable thickets ; 20–30 feet. Very abundant near the hacienda of Tabi, southeast of Ticul. A smaller species is known as Nuntsutsui.

Cereus grandiflora (Pitaya).—Abundant in the thickets, where its great depending masses impede penetration.

Cereus flagelliformis (Canchoh).—Common on rocks.

Cereus lanatus (Tsacám).

Cactus opuntia (Pakám).—The common nopal.

Melocactus communis (Polxúuk—Bisnaga).—Abundant in places.

Bromelia pinguin (Chom—Iñüela).—Abundant, and forming dense thickets.

Musa sapientia (Sac-haas).—The common banana ; extensively cultivated.

Musa paradisiaca (Box-haas).—Plantain ; also common.

Cocos nucifera.—Abundantly cultivated, and forming along the northern shore beautiful groves ; 50–70 feet.

Cocos coyol.—Dwarf cocoanut.

Sabal Mexicana (Bayal-xaan).—I am not certain that this is the common species of palmetto of Yucatan ; the tree attains a height of some 70–80 feet.

Thrinax otomale (Bon-xaan).

Thrinax parvifolia (also Bayal-xaan?).

Pandanus candelabrum (Cipil).—Stray specimens appearing here and there in the bush, between Progreso and Merida.

Pandanus utilis (Puk).—In the waters of the cenote of Balantun.